Stiphodon rubromaculatus, a new species of freshwater goby from Futuna Island (Gobioidei: Sicydiinae)

by

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ABSTRACT. - *Stiphodon rubromaculatus*, new species, is described from six males and one female collected from Futuna Island. It is distinguished from all other congeners in having 9 segmented rays in the second dorsal fin, usually 13 pectoral rays, 27-32 fine tricuspid premaxillary teeth, 0 small symphyseal teeth in female *vs* 1-2 stout teeth in males, no predorsal scales, and a low number of scales in transverse forward and back series. Males are bright red and female greyish to brownish.

RÉSUMÉ. - *Stiphodon rubromaculatus*, une espèce nouvelle de gobie d'eau douce de l'île de Futuna (Gobioidei: Sicydiinae).

Stiphodon rubromaculatus, espèce nouvelle, est décrite à partir de six mâles et une femelle collectés sur l'île de Futuna. Il se distingue des autres espèces du genre en ayant 9 rayons segmentés à la seconde nageoire dorsale, 13 rayons aux nageoires pectorales, 27 à 32 dents prémaxillaires tricuspides, aucune petite dent symphyséale chez la femelle et 1 ou 2 chez les mâles, aucune écaille dans la région prédorsale et un petit nombre d'écailles en séries transversale postérieure et transversale antérieure. Les males sont rouge brillant et la femelle grise à brun clair.

Key words. - Gobiidae - *Stiphodon rubromaculatus* - PSE - Futuna Island - Freshwater - New species.

The freshwater ichthyofauna of Futuna, an island situated between Fiji and Samoa, was completely unknown until October 2004, when a freshwater survey was conducted by the University of Perpignan, the National Museum of Natural History of Paris (MNHN), ETHYCO and the Cemagref. This small island (84 km^2) is partly covered with a primary forest, has a maximum altitude of 524 m and the rivers are short (maximum 3 km long). During this study, 18 species of freshwater fishes were found and, among them, a new species of *Sicyopus* (Keith and Marquet, 2005), a new species of *Stenogobius* (Keith and Marquet, 2006), and a new species of *Stiphodon*.

The purpose of this paper is to provide a description of *Stiphodon rubromaculatus*, n. sp., from Futuna Island.

METHODS

The methods follow those in Watson *et al*. (2005). The specimen length is expressed in standard length (SL) to the nearest tenth of a millimetre (mm). Jaw length is measured from the anterior tip of the upper jaw to the posterior edge of the maxilla. Scale counts in a lateral series are from upper pectoral base and along the middle of the body laterally to the central hypural base. Body depth is measured from the anterior base of the second dorsal fin to belly; this measurement taken only from males as females vary considerably from gravid to non gravid state. Transverse series backwards, refers to scales counted from the first scale anterior to the second dorsal fin, in a diagonal manner, posteriorly and ventrally to the anal fin base or to the ventralmost scale. Transverse series forward refers to scales counted from the first scale anterior to the second dorsal fin, in a diagonal manner, anteriorly and ventrally to the centre of belly or ventralmost scale. Zigzag series refers to scales on the narrowest region of the caudal peduncle counted from the dorsalmost scale to the ventralmost scale in a zigzag (alternating) manner.

Abbreviations used for the cephalic sensory pore system follow Akihito (1986). Abbreviations used to represent collections and institutions follow Leviton *et al.* (1985), except BLIH (Biological Laboratory, Imperial Household, Chiyoda-ku, Tokyo, Japan) formerly LICPP.

Diagrammatic illustrations of the head and of the urogenital papilla are not provided in this work because little variation exists among the many species so far described from streams entering the Pacific Ocean. The only obvious distinction so far demonstrated was for *Stiphodon martenstyni* Watson, 1998 from Sri Lanka. Some variation exists with the cutaneous sensory papillae but this is limited to the number of papillae in a row and not to their arrangement; the tendency is the smaller the species the fewer the papillae in each row.

Counts and morphometrics are summarized in tables I, II and III.

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Cybium 2007, 31(1) : 45-49.

Comparative material

The new species is compared in the text and tables with species of nearby areas, in particular *Stiphodon birdsong* Watson, 1996, *S. hydoreibatus* Watson, 1999, *S. surrufus* Watson & Kottelat, 1995, *S. tuivi* Watson, 1995 and *S. sapphirinus* Watson *et al.*, 2005, because these species have 13-14 pectoral rays and 9 segmented rays in the second dorsal fin.

Material for *S. birdsong, S. surrufus, S. hydoreibatus, S. tuivi* and *S. sapphirinus* is that listed in Watson *et al.* (2005).

STIPHODON RUBROMACULATUS, NEW SPECIES

(Fig. 1, Tabs I-III)

Material examined

Seven specimens were collected from Futuna (six males and one female) with a size range of 21.3-24.7 mm SL, and the largest male 23.5 mm SL. All specimens were adults. The metamorphosis was finished and the males were mature (urogenital papilla well-differentiated and well-coloured specimens parading on spawning grounds when caught) and the female gravid.

Holotype. - MNHN 2006-0001, male (23.1 mm SL); Vanifao River, 147 m high; S 14.28339-W 178.13614; 15 Oct. 2004; Keith, Marquet, Sasal and Labrousse, coll.

Paratypes. - MNHN 2006-0002, five males, one female (21.3-24.7 mm SL); same data as for holotype.

Diagnosis

A combination of characters distinguishes *Stiphodon rubromaculatus* from congeners. This species has 13-14 pectoral rays, 9 segmented rays in the second dorsal fin and 27-32 premaxillary teeth. There are no scales in predorsal midline. The most anterior scale along the midline is located below the anterior part of the second dorsal fin. The males have more and larger symphyseal teeth than the female (2 *vs* 0). There are 1-4 scales in transverse forward series and 7-9 in transverse backward series. The typical colouration of males is: body bright red on the flanks, orange on the belly and on the back, head bluish on cheek and nose reddish. The female is greyish to brownish.

Description

Number of premaxillary teeth in *Stiphodon rubromaculatus* and related species are given in table I, scale counts in table II, and morphometrics in table III. Below, the holotype counts are given first, followed by the paratype counts in brackets, if different.

Dorsal fins VI-I,9, first dorsal fin separate from and same height as second dorsal fin; spines not elongate or filamentous. Anal fin I,10 and directly opposite to second dorsal fin. Pectoral fin with 13 (13-14) rays, uppermost rays extending beyond membrane but not appearing feathery or silky, lowermost 1 or 2 rays simple; fin oblong with posterior margin rounded. Caudal fin with 13 (13-14) branched rays, posterior margin rounded. Pelvic disc always with 1 spine and 5 stout and heavily branched segmented rays. Fifth rays joined together in their entire length forming a strong adhesiv disc; disc adherent to belly between fifth rays only; a strong fleshy frenum between spines.

Scales in lateral series 18 (16-21), those on caudal peduncle are ctenoid and they are cycloid below the second dorsal fin. Most anterior scale along midline below anterior part of second dorsal fin.

Scales in transverse backward series 8 (7-9). Scales in transverse forward series 3 (1-4), with scales well-developed at the origin of second dorsal fin. Scales in zigzag series 7 (7-8). No scales in predorsal midline. Female has a few small cycloid scales close to urogenital papilla and anus. In males, usually no scales on belly. Head, breast and pectoral base without scales.

Premaxillary teeth 27-32, fine and tricuspid, tridentiform with central cup longer than lateral cusps. Dentary symphyseal teeth in males 1 (1-2) (female without), conical to caniniform, stronger and larger.

Cephalic sensory pore system always A, B, C, D, F, H, K, L, N and O; pore D is singular, all others are paired. Oculoscapular canal separated into anterior and posterior canals between pores H and K. Cutaneous sensory papillae developed over lateral and dorsal surfaces of head.

Sexual dimorphism well developed with adult males always having bright red coloration and longer second dorsal and anal fins than female. Urogenital papilla in males somewhat rectangular, with a rounded distal tip, while in female rectangular with tiny fimbriate projections distally.

Colour in preservation. - Males. Background of body pale orange or yellowish; many scales along and above midline below second dorsal fin with ctenii blackish; belly with few brownish pigment. Background of head orange or yellowish; occipital region with brownish pigment; preopercle behind eye with a small yellowish patch. First dorsal fin spines with 2 to 5 blackish dots evenly spaced; second dorsal fin spines and rays with 2 to 3 blackish dots evenly spaced. Caudal fin with slightly dusky brown crescent-shaped margin posteriorly; anal fin with a thin clear distal margin, below distal margin a band of brownish pigment; pelvic disk with few brownish pigment along distal margin.

Female. Background of body yellowish; light dusky black band extending midlaterally from posterior to pectoral base ending as a spot posterior to hypural base. Another light dusky brown band extends from posterior to eye ending at upper caudal rays; belly and abdomen brownish. Background of head greyish; blackish brown band from snout and

Table I. - Premaxillary teeth in *Stiphodon rubromaculatus* and related species. *[Dents prémaxillaires chez* Stiphodon rubromaculatus *et les espèces proches.]*

	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
S. nsp			1	2	2	1	-	1																					
S. sapphirinus							1	3	5	1	3	-	4	5	7	1	3	2	1	2	-	-	1	1	1	-	1		
S. birdsong				1	-	2	6	8	10	14	8	3	7	2	1	3	-	-	1	-	1								
S. hydoreibatus											2	-	2	1	3	3	1	1	1	-	1	2	-	-	-	1	-	1	
S. surrufus	1	1	1	-	-	-	-	1	-	2	-	1																	
S. tuivi										2	-	1	6	1	12	7	14	7	11	6	6	7	4	4	2	2	-	1	1

Table II. - Scale counts in *Stiphodon rubromaculatus* and related species. *[Méristique chez* Stiphodon rubromaculatus *et les espèces proches.]*

	Lateral scales																											
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
S. nsp					1	1	2	1	-	2																		
S. sapphirinus										1	1	2	2	4	5	5	9	3	3	3	2	1	1	1				
S. birdsong	1	-	2	6	3	7	5	8	6	5	4	2	4	2	-	2	2	2	-	1	1	1						
S. hydoreibatus												1	-	-	2	2	1	2	2	2	3	1	-	1				
S. surrufus											1	-	-	1	1	-	-	-	-	1	1	-	-	-	1			
S. tuivi												1	6	5	3	8	6	9	11	7	6	8	4	7	3	2	1	1

	Transverse back									Transverse forward																			
	7	8	9	10	11	12	13	14	15	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
S. nsp	2	4	1								2	2	1	2															
S. sapphirinus				40	1	1											2	3	6	7	8	6	5	3	2				
S. birdsong		4	3	3	14	16	14	7	1	2	-	2	6	2	7	7	13	9	5	4	4	1	1	-	-	-	-	1	
S. hydoreibatus			3	13																2	3	3	3	4					
S. surrufus				2	-	2	2	1		1	-	-	-	1	-	-	-	-	3	-	-	2							
S. tuivi				7	43	26	7	1														2	8	7	29	20	18	4	1

	Predorsal (M: male, F: female)														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
S. nsp M	6														
S. nsp F	1														
S. sapphirinus M	27	-	1	-	-	-	1								
S. sapphirinus F	3	-	-	1	-	-	1	3	2	-	1	1	1		
S. birdsong M	32														
S. birdsong F		55													
S. hydoreibatus M		5	-	-	1										
S. hydoreibatus F			2	-	-	3	-	-	1	-	2	2	2	2	1
S. surrufus M	3														
S. surrufus F		2	-	1											
S. tuivi M	10	6	7	8	6	2	7	6	8	4	5	1	-	2	1
S. tuivi F		1	-	-	-	-	4	2	2	2	5	5	2	3	1

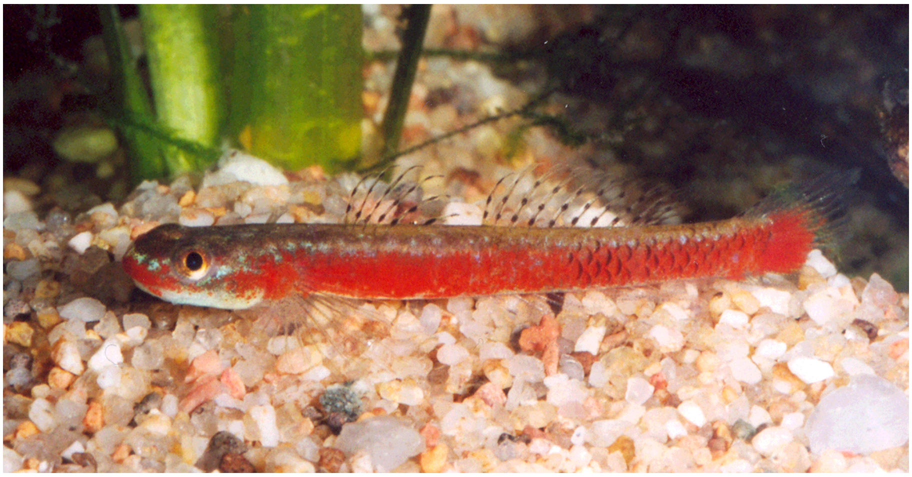

Figure 1. - *Stiphodon rubromaculatus*, paratype, MNHN 2006-0002, male (Photo by P. Keith).

Table III. - Morphometrics in *Stiphodon rubromaculatus* and related species expressed to the nearest whole percent of standard length. *[Morphométrie chez* Stiphodon rubromaculatus *et les espèces proches, exprimée en pourcentage de la longueur standard et arrondie au nombre entier le plus proche.]*

	Predorsal length										Preanal length												
	31	32	33	34	35	36	37	38	39	40	49	50	51	52	53	54	55	56	57	58	59	60	61
S. nsp			1	2	2	2							1	-	2	-	2	-	2				
S. sapphirinus				4	7	12	10	6	-	2				3	2	11	6	6	8	2	2	-	1
S. birdsong			2	7	20	23	13	2				1	-	3	9	6	10	9	11	10	7		
S. hydoreibatus		1	-	3	2	5	-	1							2	2	2	2	2	2			
S. surrufus					2	1	2	1						1	2	2	-	-	1				
S. tuivi	10	12	16	20	15	11	2				3	5	7	13	24	10	10	9	4	2	1		

	Head length							Jaw length						Caudal peduncle length													
	18	19	20	21	22	23	24	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
S. nsp			3	4				1	-	2	4			2	2	2	1										
S. sapphirinus			11	18	9	3			11	26	4										6	5	15	9	4	1	1
S. birdsong		5	25	22	11	5		6	37	23	1								1	5	12	25	15	10	2		
S. hydoreibatus		1	4	3	4			1	6	3	1											2	2	7	1		
S. surrufus				2	-	4			1	2	2	1									1	1	-	4			
S. tuivi	1	1	22	35	27	10	2		18	37	23	9	1						3	6	12	28	22	10	5	-	1

	Caudal peduncle depth						Body depth at second dorsal origin in males							
	7	8	9	10	11	12	9	10	11	12	13	14	15	16
S. nsp	1	1	5				1	3	2					
S. sapphirinus		2	14	20	5				2	11	11	2		
S. birdsong			3	36	33	2			20	11	-	1		
S. hydoreibatus			7	5						1	1			
S. surrufus			1	-	4	1			1	-	1	1		
S. tuivi		4	17	54	13				3	6	20	22	7	4

	Second dorsal fin length (M: male, F: female)																		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
S. nsp M				1	1	-	1	1	1	-	1								
S. nsp F			1																
S. sapphirinus M	1	-	-	1	-	3	2	-	1	7	3	3	3	3	1				
S. sapphirinus F		3	3	5	1	1													
S. birdsong M				1	-	3	5	8	6	4	2	1	-	1					
S. birdsong F	2	9	9	9	5	-	1												
S. hydoreibatus M								1	-	-	-	-	-	1					
S. hydoreibatus F	1	-	4	1	2	-	1												
S. surrufus M										1	1	1							
S. surrufus F		1	1	-	1														
S. tuivi M						1	-	-	-	1	9	8	7	11	13	5	4	5	1
S. tuivi F		1	5	4	7	4	1												

	Anal fin length (M: male, F: female)																		
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
S. nsp M									2	2	1	-	-	1					
S. nsp F							1												
S. sapphirinus M					1	1	-	1	-	-	5	1	4	5	5	3	-	2	
S. sapphirinus F			1	1	3	3	3	-	2										
S. birdsong M									1	6	8	7	6	4					
S. birdsong F	1	-	-	-	1	4	12	12	5	1									
S. hydoreibatus M														1	-	-	-	-	1
S. hydoreibatus F				1	-	1	2	2	3	-	-	1							
S. surrufus M												1	-	2					
S. surrufus F		1	1	-	-	1													
S. tuivi M									4	3	3	8	13	8	13	7	2	3	1
S. tuivi F			2	2	5	2	2	2	4	1	2								

	Caudal fin length (M: male, F: female)											
	17	18	19	20	21	22	23	24	25	26	27	28
S. nsp M	1	1	-	3	-	1						
S. nsp F	1											
S. sapphirinus M			2	-	2	3	5	11	2	2	-	1
S. sapphirinus F			1	-	2	5	2	3	1			
S. birdsong M				1	3	3	2	2	2			
S. birdsong F				1	1	8	6	1				
S. hydoreibatus M								1	-	-	-	1
S. hydoreibatus F				1	-	3	3	1	1	-	1	
S. surrufus M										1	2	
S. surrufus F					1	-	2					
S. tuivi M	1	1	2	19	13	14	10	4	1			
S. tuivi F		2	6	8	4	2						

upper lip to central pectoral base. First dorsal fin clear except for fine brownish pigment along anterior and posterior edges of each spine; second dorsal fin clear, spine and rays with dusky brown pigment; caudal fin clear, rays without pigment; anal fin mostly clear; pelvic disk free of pigment; pectoral fin clear.

Colour in life. - Males (Fig. 1). Generally bright red on side of head and body. Dorsal part of body and belly more orange. Cheek red with an upper blue part; red nose with an upper blue line. Posterior margin of scales blackish. All fins hyaline, some with dark dots: 2 to 5 black dots on each rays of the first dorsal fin; 2 to 3 black dots on each rays of the second dorsal fin. Caudal fin hyaline with a reddish part at its base.

Female. Body generally transparent or greyish; dusky markings as in preservation. Belly whitish to yellowish.

Distribution and ecology

Known from rivers of Futuna Island.

Like other Sicydiinae, *Stiphodon rubromaculatus* is found in clear, high gradient streams with rocky bottom. It lives on the bottom of the river, on top of rocks but it is also often seen swimming in open water in the stream between rocks or in large pools. This species was observed from 90 to 200 m high in altitude.

Comparison

Stiphodon rubromaculatus differs from *S. sapphirinus*, *S. tuivi* and *S. hydoreibatus* in having less premaxillary teeth (27-32 *vs* 31-51/34-53/35-52) and lower scale counts (16-21 in lateral scales *vs* 21-35/23-39/23-35; 7-9 in transverse backward series *vs* 10-12/10-14/9-10; 1-4 in transverse forward series vs 7-15/12-19/10-14). *Stiphodon rubromaculatus* differs from *S. surrufus* in having less lateral scales (16-21 *vs* 22-36) and in transverse backward series (7-9 *vs* 10-14), and a shorter caudal peduncle in length (12-15 *vs* 19-22) and depth (7-9 *vs* 9-12). *Stiphodon rubromaculatus* seems to be most related to *S. birdsong* but it differs in having less premaxillary teeth (27-32 *vs* 28-45), less scales in transverse backward series (7-9 *vs* 8-15) and a shorter caudal peduncle in length (12-15 *vs* 17-23).

Etymology

The species is named *rubromaculatus* (latin: red - stained) with reference to the distinctive colour pattern of males.

Acknowledgments.- For help during Futuna expedition : N. Mary (ETHYCO), P. Sasal (University of Perpignan), C. Flouhr (HYTEC), A. Dutartre (Cemagref), D. Labrousse (Environmental service of Wallis and Futuna), Vanai Paino (Environmental service of Wallis and Futuna) and all people of Futuna for their kindness.

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Reçu le 23 janvier 2006.
Accepté pour publication le 21 mai 2006.